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Ion Collector Design for an Energy Recovery Test Proposal with the Negative Ion Source NIO1

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Commercial viability of fusion power plants depends also on minimizing the recirculation power used to operate the reactor. In thermonuclear fusion research, the neutral beam heating is one of the most important ways to ensure the plasma heating. For the future fusion power plant project DEMO, a neutral beam wall plug efficiency at least of 0.4 ÷ 0.55 is required[1]. The neutral beam wall plug efficiency foreseen for the present fusion reaction project (ITER) instead is only about 20% [1]. Neutral beams are realized by using a negative ion source whose D^- beam can be neutralized by a gas cell. In that process the production efficiency of the neutral beam is lower than 55% but an increase up to75% could be obtained when an ion beam energy recovery system is applied[2].

Recently the test negative ion source NIO1 (60 keV, 9 beamlets with 15 mA H^- each) has been designed and built at RFX (Padua) to study how negative ion production efficiency and the beam quality could be improved in fusion application [3].

In this paper a proposal to use the NIO1 source also for a beam Energy recovery test experiment is done and a preliminary design of a negative ion beam collector with simulations of beam energy recovery is also presented and discussed.

References

[1] R. Mc Adams, 'Beyond ITER:Neutral beams for DEMO', invited paper on Proceedings ICIS 2013, Chiba, Japan.

[2] H. J. Hopman, 'Energy Recovery for Negative Ion Based Neutral Beam Lines', Nuclear Fusion, vol.29, n. 4, (1989)

[3] M. Cavenago et al.,'NIO1 a Versatile Negative Ion Source', on Proceedings IPAC 2010, Kioto, Japan.